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ABSTRACT

A study investigated the reciprocal relationship between colors and semantic terms--just as certain semantic terms elicit thoughts of particular colors, so those colors may also elicit their reciprocal semantic terms. Twenty-six students were each shown 18 words: 3 each of bipolar pairs that expressed evaluation, activity, or potency. The students were asked what color came to mind when they read each word. They then were asked to select the coded color swatch that most closely matched that color. In terms of evaluation, negative words tended to elicit a reddish, dark gray, whereas positive words tended to elicit a light gray. In terms of activity, active words tended to elicit a weak red, whereas passive words elicited a blue gray. In terms of potency, strong words tended to elicit a weak red, whereas weak words elicited a light gray. Findings suggest a greater importance of color's role in communication, and that perhaps in the study of communication there has been an undue tendency toward verbocentrism and an aversion to other symbols, including the study of color. (Contains 13 references, and six tables and three figures of data. The questionnaire is attached.) (Author/RS)

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Preliminary Exploration of the Chromatic Differential:

The Measurement of the Meaning of Color

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Presented at Vis-Com '94 (Eighth Annual Visual Communication Conference) at Feather River Inn, CA, June 24, 1994.

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Abstract

This paper investigates the reciprocal relationship between colors and semantic terms. Just as certain semantic terms elicit thoughts of particular colors, so those colors may also elicit their reciprocal semantic terms.

Twenty-six students were each shown 18 words: three each of bipolar pairs that express evaluation, activity, or potency. The students were asked what color came to mind when they read each word. They then were asked to select the coded color swatch that mostly closely matched that color. In terms of evaluation, negative words tend to elicit a reddish, dark gray, whereas positive words tend to elicit a light gray. In terms of activity, active words tend to elicit a weak red, whereas passive words elicit a blue gray. In terms of potency, strong words tend to elicit a weak red, whereas weak works elicit a light gray.

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In reviewing the literature on the meaning of color, no research was found on the reciprocal relation between color and semantic meaning. The purpose for the paper, therefore, is to test whether there is a reciprocal relationship between the meaning of semantic terms and the colors they elicit.

Background

A substantial body of literature testifies to the investigation of the relationship between color and connotative meaning. Important works in the exploration of color include those of Birren (1934) and Munsell (1946) who developed scales for colro notation, Albers (1963) who explored fluid perception of color, and Lüscher (1969) who related color preference to personality.

Rorschach (1951) said, "It is... generally safest to begin [the Rorschach test analysis] with the color responses; these responses have been found empirically to be representatives of the affectivity, the total affective responsiveness. Similarly, Levy (1984) found clear evidence of a valid relationship between color and patterns of emotion.

Research findings on this topic, though, are not all in agreement. Holmes (1984) found little agreement between the results of the Lüscher Color Test and the Minnesota Multiphasic Personality Inventory of 42 counseling graduate students. Similarly, Cerbus and Nichols (1963) found no support for the association of response to color and personality attributes.

By far, the person who was found to have most extensively investigated the affective meaning of color was Charles Osgood. As the inventor of the semantic differential, Osgood conducted extensive research into the measurement of meaning, including the meaning of color. Interestingly, although he wrote about the color solid analysis of colorimetry (1953), Osgood did not include this quantitative measurement of color in his writings on the meaning of color.

Osgood created the semantic-differential technique to compare the meanings of words (with pairs of polar-opposite words at the two ends of each scale). With this research tool he found that emotional moods translate across all the senses. Osgood discovered that about 50% of the meaning in language usage can be reduced to a simple positive or negative evaluation. Positive evaluations (+E) are represented by words such as good, kind and honest; negative evaluation (-E) by words such as bad, cruel and dishonest. Another 25% of identifiable meaning is due to judgment of potency. Potency (+P) is represented by words such as strong, hard, and heavy; impotency (-P) by words such as weak, soft, and light. About 15% of meaning is due to judgement of activity (+A), represented by words such as active, fast, and hot, as opposed to inactivity (-A) represented by words such as passive, slow, and cold. Less than 10% can be attributed to all other factors. The three factors—evaluation (E), potency (P), and activity (P)—allowed him to plot the locations of thoughts and ideas in three-dimensional semantic space (Osgood, 1975).

Below are selections of Osgood's findings on the affect of color. Unfortunately, in his comparison of his data to the work of many others, he states, "...we have not distinguished between the use of color words and color patches as stimuli" (Osgood, 1975, p. 319). Table 1 summarizes these data.

> The E, P, and A characteristics of the colors may be summarized... as follows. White, with 88% of its weighted associations in +E sectors, 73% in ^{0}P (or -P), and ^{0}A. Gray, with 88% of its weighted associations in -E sectors, 63% in ^{0}P sectors but a larger percentage than any other color (26%) in -P sectors, and 44% in -A sectors, is -E, -P, and -A. Black, similarly, is -E, ^{0}P, and -A. Red is higher that other colors in the ^{0}E sectors and not outstanding in the +E or -E sectors and hence may be considered neutral on E; but it is far higher that other colors in P and A. Yellow has a smaller percentage of associations in neutral E sectors than any other color (5%) and seems to be bimodel on E; it is +A like red but, unlike red, is not +P. Green, along with white, has the highest percentage of associations in +E sectors; its P and A are less well defined. Blue is also stronger +E and firmly ^{0}P and -A. (Osgood, 1975, p. 327)

Insert Tables 1 and 2 about here

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What is the reciprocal of this data matrix? That is, if individuals were presented with the words used in the semantic differential, what colors would they think of? Table 2 presents the probable responses, based on the reciprocal of the data above. These are the anticipated responses to the research presented in this paper.

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Method

Today photographers and graphic artists simulate the appearance of a full spectrum of color by the use of the three subtractive primary colors—cyan (process blue), magenta (process red) and yellow. As these colors are printed in different sized halftone dots, they give the impression of different solid hues and tones. Each of the three primary colors can be presented as a different dimension, such as shown in the *Pantone Process Color Selector.* Each page in this color guide has an 11x11 matrix of 121 different color squares. The vertical columns vary in magenta, with the far left being 0% (devoid of magenta), and the far right being 100% (solid magenta). The horizontal rows vary in the same way in cyan, with the top being 0% and the bottom being 100%. Sequential pages vary in yellow, with the back being 0% and the front being 100%. Among these 1,331 color squares are all the colors possible (within 10%) in photographs and in full-color printing. In the color selector, each color is numerically coded, with the first three digits representing the percentages of each of the three subtractive primaries. Color, therefore, can be denoted as ratio-level data, making inferential statistical techniques possible. There is face validity in the use of such scales since they have been used for decades throughout the graphic arts industry.

The tests for this paper were done in the spring of 1991, using the survey results from 26 college students; the results from two color blind students were eliminated.

The survey instrument contained 18 words used in the semantic-differential technique (Griffin, 1991). The reliability of the results was improved by this use of sets of three different words rather than a single indicant for each pole. The subjects were instructed to think about just one of these words at a time, and then to notice what color came to mind. They were then told to find in a *Pantone Color Selector* the color that most closely matched the color they imagined. The three-digit code from each color was entered on NCS answer sheets.

The survey instrument is similar to a semantic-differential except the three dimensions being sought are the three primary colors rather than semantic meanings. It is appropriate, then, to call these chromatic-differential scales.

Results

Conventional assumptions were checked: the subjects were independent; the distributions were tested for normality and variances were tested for homogeneity. The ANOVA technique was used, with Scheffe tests run to check for significant main effects.

Activity

The overall results regarding words of activity were significant ($F_{[5], 21.52}$, $p < .01$). The set of active words elicited a weak red; the set of passive words elicited a blue gray.

There was a significant main effect found in terms of color ($F_{[2]} = 6.67, p < .01$). The Scheffe test in table 3 shows that the mean score for magenta is significantly different from cyan.

There was a significant main effect between sets of active and passive words ($F_{[1]} = 15.60, p < .01$), with the set of active words being darker.

There was a significant interaction between the activity level of the sets of words and color ($F_{[2]} = 39.33$, $p < .01$). Figure 2 shows a significant disordinal interaction, with cyan running counter to the magenta and yellow.

Insert Table 3 and Figure 1 about here

Evaluation

The over all results regarding words of evaluation were significant ($F_{[5]} = 62.97$, $p < .01$). The set of positive words elicited a light gray; the set of negative words produced a reddish, dark gray.

Insert Table 4 and Figure 2 about here

Although there was no main effect found in terms of color ($F_{[2]} = 0.38$, $p > .05$), there was a significant main effect between sets of positive and negative words ($F_{[1]} = 297.17$, $p < .01$). Figure 1 shows how the set of negative words produced a much darker result.

There is also a significant interaction ($F_{[2]} = 8.45$, $p < .01$), with there being slightly more cyan in the positive set and less cyan in the negative, than magenta and yellow.

The over all results regarding words of evaluation were significant ($F_{[5]} = 45.36$, $p < .01$). The set of potent words elicited a weak red; the set of weak words produced a light gray.

There was a significant main effect found in terms of color $F_{[2]} = 32.64$, $p < .01$), with cyan being lighter than magenta and yellow. There was a significant main effect between sets of potent and weak words ($F_{[1]} = 128.94$, $p < .01$), with the potent set being darker.

There were also significant interactions ($F_{[2]} = 16.30$, $p < .01$). Figure 3 shows a disordinal effect between magenta and yellow, as well as ordinal interactions between cyan and magenta and between cyan and yellow.

Insert Tables 5 and 6 about here

Discussion

Since Osgood did not describe color in measurable terms, the data can be presented no more precisely than that in table 6. The results of the chromatic differential either match or are closely similar to what one might predicted from Osgood's finds. Therefore the chromatic and semantic meanings are reciprocal.

Therefore, not only do words carry chromatic meanings, but colors carry verbal meanings. Beyond simple chromatic denotations, such as the color coding of resistors used in electronics, these findings support the idea that colors connote predictable affective meanings.

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Insert Table 6 about here

This strong reciprocal relationship between chromatic and semantic terms supports Osgood's theory that individual signs, such as words and colors, associate together into an internal response or meaning (Littlejohn, 1989, p. 72). This suggests a greater importance of color's role in communication, vis-à-vis language, than may have been examined previously by the academy. Perhaps in the past there has been in the study of communication an undue tendency toward verbocentrism, and an aversion to the other symbolss, including the study of the meaning of color.

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References

Birren, Faber (1934). *Color Dimensions; Creating New Principles of Color Harmony and a Practical Equation in Color Definition.* Chicago: The Crimson Press.

Cerbus, George, & Nichols, Robert C. (1963). "Personality Variables and Response to Color" Psychological Bulletin, vol. 60, 566-575.

Griffin, Em (1991). *A First Look at Communication Theory.* New York: McGraw-Hill.

Holmes, Cooper B. and others (1984). "Relationship between the Lüscher Color Test and the MMPI." *Journal of Clinical Psychology,* 40, 126-28.

Levy, Bernard I. (1984). "Research into the Psychological Meaning of Color" *American Journal of Art as Therapy.* vol 23(2) pp 58-62.

Littlejohn, Stephen W. (1989). *Theories of Human Communication.* Belmont, CA: Wadsworth.

Lüscher, Max (1969). *The Lüscher Color Test.* New York: Random House

Munsell, A. H. (1946). *A Color Notation.* Baltimore: Macbeth.

Osgood, Charles E. (1953). *Method and Theory in Experimental Psychology.* New York: Oxford University Press.

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Osgood, C., May, W. H., & Miron, M. S. (1975). *Cross-Cultural Universals of Affective Meaning*. Urbana: University of Illinois Press.

Osgood, C. E., Suci, G. J, & Tannenbaum, P. H. (1967). *The Measurement of Meaning*. Urbana: University of Illinois Press.

Pantone (1983). *Pantone Process Color Selector*. Moonachie, NJ: Pantone.

Rorschach, H. (1951). *Psychodiagnostics: A Diagnostic Test Based on Perception* Bern: Hans Huber

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Table 1

White	Gray	Black	Red	Blue	Green	Yellow
+E	-E	-E	^{o}E	+E	+E	±E
o/-P	-P	^{o}P	+P	^{o}P	?P	not +P
^{o}A	-A	-A	+A	-A	?A	+A

Table 2

Positive	ACTION	Negative
Red, Yellow		Gray, Black, Blue

Positive	EVALUATION	Negative
White, Blue, Green		Gray, Black

Positive	POTENCY	Negative
Red		Gray

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Table 3

Mean	N	COLOR
47.7%$_a$	52	MAGENTA
42.4%$_{ab}$	52	YELLOW
33.7%$_b$	52	CYAN

Mean	N	TYPE
47.6%$_a$	78	ACTIVE
35.0%$_b$	78	PASSIVE

COLOR	ACTIVITY	N	Mean
CYAN	ACTIVE	26	20.13%
CYAN	PASSIVE	26	47.31%
MAGENTA	ACTIVE	26	64.87%
MAGENTA	PASSIVE	26	30.64%
YELLOW	ACTIVE	26	57.69%
YELLOW	PASSIVE	26	27.18%

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Table 4

Mean	N	TYPE
72.6%$_a$	78	Negative
23.0%$_b$	78	Positive

Level of COLOR	Level of TYPE	N	Mean
CYAN	Negative	26	64.0%
CYAN	Positive	26	30.9%
MAGENTA	Negative	26	79.6%
MAGENTA	Positive	26	19.4%
YELLOW	Negative	26	74.1%
YELLOW	Positive	26	18.8%

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Table 5

Mean	N	COLOR
39.8_a	52	YELLOW
37.8_a	52	MAGENTA
13.7_b	52	CYAN

Mean	N	TYPE
$47.1\%_a$	78	POTENT
$13.7\%_b$	78	WEAK

Level of COLOR	Level of TYPE	N	Mean
CYAN	WEAK	26	07.2%
CYAN	POTENT	26	20.1%
MAGENTA	WEAK	26	10.8%
MAGENTA	POTENT	26	64.9%
YELLOW	WEAK	26	23.2%
YELLOW	POTENT	26	56.4%

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Table 6

Positive	ACTION	Negative
Red, Yellow	Anticipated	Gray, Black, Blue
Weak Red	Found	Blue Gray

Positive	EVALUATION	Negative
White, Blue, Green	Anticipated	Gray, Black
Light Gray	Found	Reddish, Dark Gray

Positive	POTENCY	Negative
Red	Anticipated	Gray
Weak Red	Found	Light Gray

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Figure 1

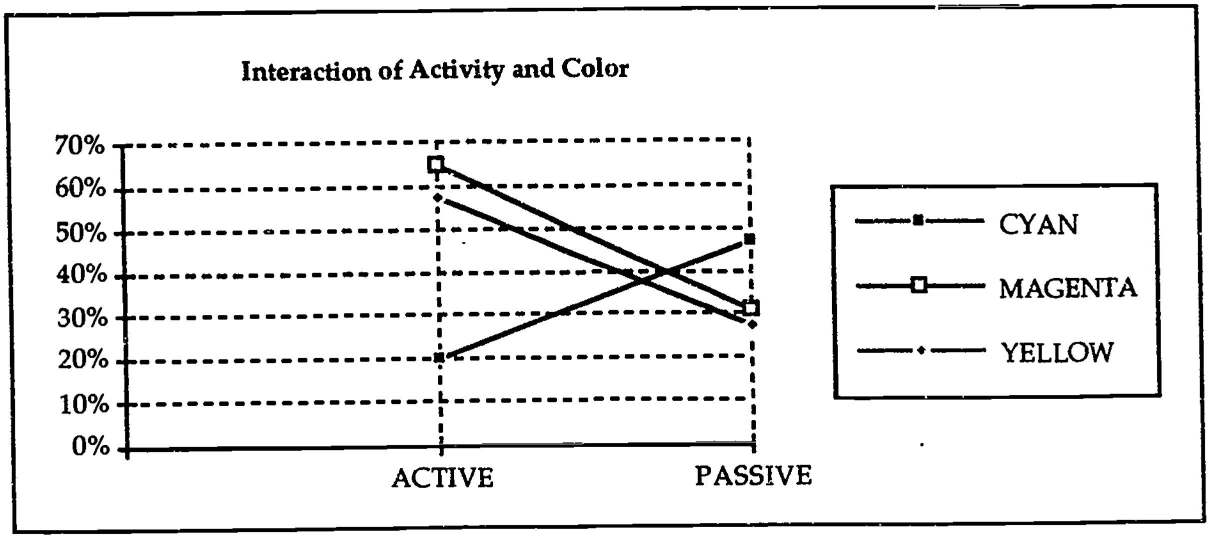


Figure 2

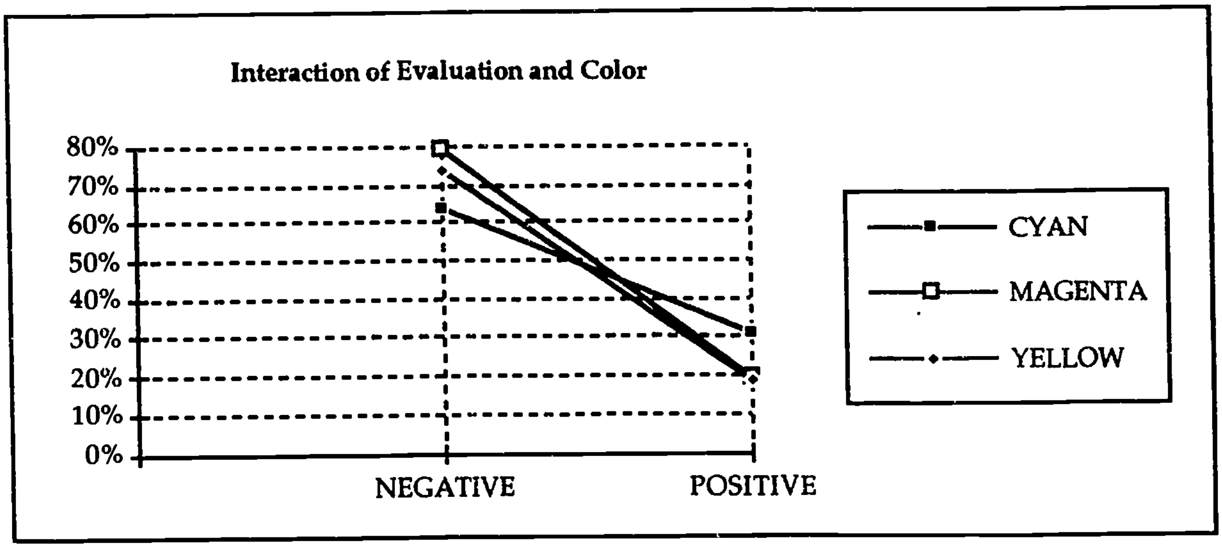
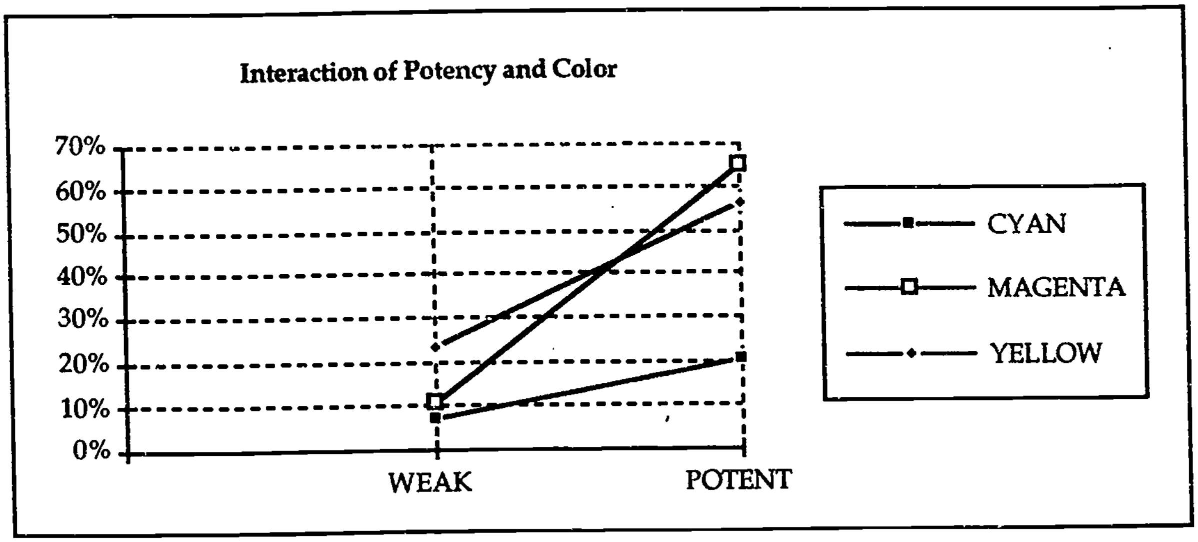


Figure 3



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Appendix

Mass Media Research

Project Questionnaire

This is a survey that must be used with the *Pantone Process Color Selector*, which is on reserve in the library, and a green general purpose NCS answer sheet. Be sure to use only a #2 pencil.

First, notice that below are eighteen words (used by Charles Osgood with his semantic differential). Think about just one of these words at a time. Begin by thinking of the first word, "good." Notice what color comes to mind when you think of this word.

Second, find in the *Pantone Process Color Selector* the color that most closely matches the color you have imagined. Notice that at the bottom of that color there are four digits that follow an "S-." Notice what the first three of those digits are; they are your correct answers.

Third, mark these three answers on the general purpose NCS answer sheet as follows: put the first of the three digits as the answer for question #1, the second for question #2, and the third for question #3.

There are only two exceptions to this. Since there is no "0" on the answer sheet, use the answer "10." Some colors have an "X" in place of a digit. Should you select such a color, use a "9" to indicate an "X." These two exceptions are summarized below:

X = 9

0 = 10

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Four, once you have completed this, repeat these same steps for the other 17 words, until you have completed the full 54 responses.

Fifth, when you are through, enter your name on the answer sheet, filling in the bubbles.

I. Evaluative

Good

1. First digit
2. Second digit
3. Third digit

Bad

10. First digit
11. Second digit
12. Third digit

Kind

4. First digit
5. Second digit
6. Third digit

Cruel

13. First digit
14. Second digit
15. Third digit

Honest

7. First digit
8. Second digit
9. Third digit

Dishonest

16. First digit
17. Second digit
18. Third digit

II. Potency

Strong

19. First digit
20. Second digit
21. Third digit

Weak

28. First digit
29. Second digit
30. Third digit

Hard

22. First digit
23. Second digit
24. Third digit

Soft

31. First digit
32. Second digit
33. Third digit

Heavy

25. First digit
26. Second digit
27. Third digit

Light

34. First digit
35. Second digit
36. Third digit

III. Activity

Hot

37. First digit
38. Second digit
39. Third digit

Cold

46. First digit
47. Second digit
48. Third digit

Fast

40. First digit
41. Second digit
42. Third digit

Slow

49. First digit
50. Second digit
51. Third digit

Active

43. First digit
44. Second digit
45. Third digit

Passive

52. First digit
53. Second digit
54. Third digit